Virtual Reality Technology: A Closer Look

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Abstract

What would it be like to travel the galaxy or even create worlds of your own? With virtual reality (VR) technology all of this could be possible. The applications of VR extend beyond recreational use and are valuable in areas such as medical and dental training, architectural design, and scientific research. Advancements in VR are proving to be a significant development in redefining how mankind uses technology. Categories of equipment range from gloves, wands, head mounted displays, to sensors which track body movement. The technology should be interactive, explorable and immersive. To do this requires a computer-generated interface because the user is witnessing a virtual world in real-time, capable of moving around and exploring the environment. Applications in the medical field rang from surgical training to pharmacological design. VR game stands to dramatically challenge the constructs of the education process in years to come. With new technology comes new legality concerns. Aside from the immersive virtual environment, it is relatively the same as most gaming atmospheres. Like any device connected to the internet, VR platforms are susceptible to security risks. As time progresses new security risks will likely arise, but we can be assured that so too will our awareness.

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Take a moment and visualize yourself somewhere else. Were you thinking of a memory, a place, an event in history? Imagine running with the bulls in Spain, scaling the rock walls of Mount Everest, or sitting atop the Great Sphinx of Giza in ancient Egypt. What would it be like to travel the galaxy or even create worlds of your own? With virtual reality (VR) technology all of this could be possible. Different from the reality we find ourselves in daily, VR is a simulation or recreation of our perceived reality. Our imagination is riveted when introduced to the combined experience of seeing, hearing, and feeling like we are in a virtual world. Using specialized equipment and platforms such as the Oculus Rift and HTC VIVE, individuals can experience VR technology through an expansive variety of games and virtually constructed realities.

Entertainment aside, the applications of VR extend beyond recreational use and are valuable in areas such as medical and dental training, architectural design, and scientific research. VR can aid anxiety by providing rehabilitation in some forms of therapy and is even being used in educational and psychological research (Rosa and Breidt, 2018, p. 427-430). New advancements in VR are proving to be a significant development in redefining how mankind uses technology. This essay will examine VR in further detail, including the background of what constitutes VR technology and the necessary equipment involved. Furthermore, this paper will examine VR applications in medicine, science, and education in addition to design and architecture, as well as the positives and negatives regarding the legal, social, ethical, and security standpoints associated with its use.

Background

Equipment Hardware and Software:

Categories of equipment range from gloves, wands, head mounted displays, to sensors which track body movement. The movement of users is tracked from a motion sensor in the head mounted display to stationary sensors in the field of operation. With the innovation of computer hardware and software technology, virtual simulation technology has been applied in various fields, including sports training and basketball teaching process (Hou et al., 2014, p. 651-653). Of course, it is the combination of all the functionalities utilized through one interface which creates an efficient piece of technology. The development in sensor technology have come a long way and there is a lot of science behind the algorithms used to display the interactive 3-dimensional worlds. Using a WLAN link, generated data packets are transmitted to the associated VR computing device which requires a very high throughput and low latency to satisfy the high-resolution video images (Ahn, et al., 2018, p. 3-5). The recommended type of hardware to run this type of operation is recommended by the VR manufacturing companies. The Oculus Rift's basic requirements are:

A video card, "NVIDIA GTX 1060 / AMD Radeon RX 480 or greater", a CPU, "Intel i5-4590 equivalent or greater", memory, "8GB+RAM", video output, "compatible HDMI 1.3 video", USB ports, "3x USB 3.0 ports plus 1x USB 2.0 port", and an operating system, "Windows 7 SP1 64 bit or newer" (Lang, 2018, n.p.).

While this can get expensive, the hardware required to experience VR worlds should be capable of seamlessly running the necessary programs with ease.

What constitutes a Virtual Reality:

The entirety of the VR experience needs to be believable, but what does this entail? The technology should be interactive, explorable and immersive. To do this requires a computer-generated interface because the user is witnessing a virtual world in real-time, capable of moving around and exploring the environment (Woodford, 2018, para. 3). The experience should be mentally and physically engaging, which means manipulating every sense possible to create this believable virtual reality.

Imagine the rumbling in the hands of a racecar driver gripping the steering wheel crossing the finish line, the sound of artillery above as a fighter pilot enters the cockpit, or the sight through a rifle scope on a mountain top as a hunter scans the horizon. These otherwise unimaginable activities become possible when beginning to alter our senses and the minds perception of reality. Tactile and audible interactivity combined with sight and motility in a computer-generated world manipulates the human senses just enough to create a convincible virtual reality experience. The applications in VR are seemingly limitless.

Applications

Medical:

Applications in the medical field rang from surgical training to pharmacological design. Other advancements in VR include healing patients, clinical education, and an overall rebirth of healthcare (Nichol, 2017, p. 1-2). Patients awaiting surgery can ease their nerves on a virtual beach or meditate in a calming environment. Individuals without mobility can witness the world in a different way through experiences in dynamic surroundings and environments.

The benefits of VR in the medical industry provide high quality simulation, planning, and patient staging, as well as improved capabilities for physicians, such as radiologists and coupling

of diagnostic radiology expertise, laparoscopic surgery, nuclear medicine, and radiation therapy (Vosburgh, et al., 2013, p.6). Most notably laparoscopic surgery can be practiced and mastered virtually without the use of real patients (Yiannakopoulou et al., 2015, p. 61). Now, neurosurgery stands as an elective medical procedure (which was not always the case), and currently patients can be out of the hospital in as little as a couple of days. This is greatly due to the advancements in imaging, visualization, and operative techniques (Vosburgh, et al., 2013, p.6), which allow for a better medical understanding of the anatomy and pathology that are the targets of the intervention.

Scientific:

Imagine the virtual possibilities concerning fields such as organic chemistry or microbiology. Author, Steve Bryson (1996) believed scientific visualization was potentially a very fruitful application area for VR and should be pursued aggressively (p. 70). He was right, and advancements have allowed just that. While 90's technology was primitive by today's standard, Bryson correctly identified the necessity to utilize VR for scientific study. The capability of visually and physically interacting with an environment of molecules or compounds is groundbreaking. The ability to manipulate such information from different perspectives is certainly the way of the future. Imagine the benefits one gains with the ability to use VR training to prepare for dangerous or jobs or specific detail-oriented tasks.

Educational:

"VR has the potential to revolutionize education, as it immerses students in their learning more than any other available medium" (Gadelha, 2018, p. 40). There is an abundance of programs available including interactive games and curriculum consisting of video and animation to create a learning environment free of distraction or interruption (Gadelha, 2018, p.

40-43). The imagination of the student is free to roam, and what was once a predictable

classroom setting becomes an adventure in which solving puzzles and answering questions

propels students to learn. This mixture of learning while having fun playing a VR game stands to

dramatically challenge the constructs of the education process in years to come.

Architecture and Design:

Not long ago, architectural design was conducted out of blueprints and cardboard models.

Today we find an entirely different realm of possibility. There are games like Minecraft and

Sims which allow users to build a virtual world. Using VR technology, these worlds are

becoming more lifelike than ever imagined. Similarly, tasks such as home design and

infrastructure planning can be designed and displayed to illustrate ideas. Whether the VR aids in

finding that perfect color scheme for the living room or to virtually show development plans in

place of a 2-D blueprint, it is merely the evolution of ways of understanding or interpreting

information.

<div align="center">

Positives and Negatives

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Legal and Social:

With new technology comes new legality concerns. Games like Second life have avatars

which are not exactly representative of the person playing. Through avatars, a social aspect of

VR becomes possible where players can interact with thousands of people online (Tennesen,

2009, p. 27–28). Because of the social interactivity there always possibility for criminal activity

to take place. Currently, there are little to no legal process for a transaction between two players.

This means one party could lend money to another with only a promise that it will be paid back.

Only the trust among players bonds this agreement, and as one may surmise, there are often

consequences resulting in players losing money or revealing private information which can be

used against them. On the other hand, however, the involvement is figuratively out of this world, so it is understandable how one can overlook the negatives and enjoy the VR experience as it was intended. Most individuals interested in enjoying a VR experience find the positive legal and social issues outweigh the negatives. VR technology is legal and socially accepted. There is no cause for concern regarding the use of this technology at this time, nor does it seem anything will prevent the future developments in the VR industry.

Ethical:

It is not difficult to imagine the types of interactions taking place in games like Second life or World of Warcraft. Aside from the immersive virtual environment, it is relatively the same as most gaming atmospheres. There is little to no framework for controlling one's actions outside the spectrum of the game. If someone is spending an average of 20 hours a week immersed in the fantasy world, it is likely that they may have less regard for the real one (Tennesen, 2009, p. 27–28). This could lead to an abundance of problems, including seclusion, isolation, and separation from society. In films such as *Ready Player One*, people have found more value in the virtual world than the real one. We see money, competition, greed, sex, and everything else imaginable suspect to conscience and integrity of individual players. On the positive side, it can be assured that the ethics of using this technology is mostly left in the virtual world. Actions, however, still have consequences. Therefore, one should avoid unethical behavior and avoid engaging in any suspicious activity online. Above all else, personal information should never be disclosed over the internet.

Security:

Like any device connected to the internet, VR platforms are susceptible to security risks. There are issues such as malware which could feasibly access the VR devices camera, or even

track the motions a user makes while using the technology (Lang, 2018, para. 6). Essentially, there is a possibly that someone may be able to track what one does or watches at any time. Of course, these concerns are not new information in this age of technology. Many people are aware of these risks and still use VR platforms. VR technology is like any other device with online capability, it can be hacked and there are possibilities for viruses. On the positive side, VR technology functions through a computer, so up to date antivirus software aids in the prevention any unwanted security risks. As time progresses new security risks will likely arise, but we can be assured that so too will our ability to combat them.

Conclusion

This essay has taken a closer look into a range of VR related applications and the variety of uses the technology holds, extending from the equipment used and the beliefs which constitute one's predilection to accept a virtual world. An examination of applications in medicine, science, and education in addition to design and architecture have been identified, as well as the positive and negative connotations relating to the legal, social, ethical, and security perspectives related to the use of VR technology. It stands to reason that every issue discussed in this paper has illustrated a need or improvement that VR technology can provide to a business or just common individuals. While the applications are boundless, it is true that there are always risks concerning the implementation of new technology. If users respect the equipment and know what they are doing there should be no cause for any concern.

References:

Ahn, J., Young, Y. K., & Kim, R. Y. (2018). Virtual reality-wireless local area network:

Wireless connection-oriented virtual reality architecture for next-generation virtual reality

devices. Applied Sciences, 8(1), 43. DOI: http://dx.doi.org/10.3390/app8010043

> The authors of this article examine the mixture of traffic carried in their networks.
> There are several reasons relating to knowledge regarding traffic composition as a
> valuable network for planning, accounting, security, and traffic control. This
> source was specifically referring to how WLAN link generated data packets are
> transmitted to the associated VR computing device because this requires a very
> high throughput and low latency to satisfy the high-resolution video images. It
> was a good source to set up another source which explains how the
> interconnectivity of the equipment is necessary. It was also not possible years ago.

Gadelha, R. (2018). Revolutionizing Education: The promise of virtual reality, Childhood

Education, 94:1, 40-43, DOI: 10.1080/00094056.2018.1420362

> The article discusses the potential benefits of blocking out visual and auditory
> distractions in the classroom. The article goes on to say VR has potential to help
> students deeply connect with the material they are learning in a way that has never
> been possible before. This article was reliable and discussed the virtual
> technology applications in education. Overall, it helped strengthen the
> understanding of how a student can get distracted in the classroom and technology
> could possibly help this.

Hou, H.W., Wang G. and Zhang G.W. (2014). Virtual simulation technology of wireless sensor

neural network in basketball movement distribution. Applied Mechanics and Materials, 651-653,

579–583. DOI: 10.4028/ www.scientific.net/AMM.651-653.579

> The authors discuss the applications of virtual simulation technology, and how it
>
> has been has been applied in various fields, including sports training and
>
> basketball teaching process. The source was a good example to explain the
>
> connectivity for VR. In source the paragraph, it describes various advancements
>
> in VR technology has been applied in various fields. Specifically, teaching and
>
> education, although the source was mainly referring to the use in sports.

Lang, B. (2018, February 14). Check if your PC is VR ready for Oculus Rift, HTC VIVE &

windows 'mixed reality' VR headsets. Retrieved from https://www.roadtovr.com/how-

to-tell-pc-virtual-reality-vr-oculus-rift-htc-vive-steam-vr-compatibility-tool on September

25, 2018.

> This article comments on both specs (Oculus Rift and HTC VIVE), which it turns
>
> out are nearly identical. This is because the equipment is equally reliant on a
>
> powerful computing source. Each company provides to check to see if your
>
> computer is VR ready. This information was reliable and it well organized. It was
>
> an ideal source to show what kind of hardware is required to run a VR device.

Tennasen, M. (2009). Avatar acts. Scientific American, 301(1), 27–28. DOI: 10.1038/

https://www.scientificamerican.com/article/avatar-acts/

> The author of this article comments on worldwide popular online communities
>
> like Second Life and the creation of Linden Labs active-user base of one million
>
> with a real-time experience on their personal computers with characters called

avatars to wander around. I thought this source was reliable because it focused on the ethical issues with VR. It was difficult explaining how ethics is, like many things, a part of what should be considered concerning new technologies.

Nichol, P. B. (2017). Healthcare VR innovations are healing patients. CIO. Retrieved from https://www.cio.com/article/3164537/virtual-reality/healthcare-vr-innovations-are-healing-patients.html on September 21, 2018.

The list of possibilities for VR is endless. Augmented and virtual reality medical solutions are removing distractions, improving the quality of critical thinking, and maturing learning solutions, saving time and money while supercharging the learning experience. The source was a good example to explain the innovations in healthcare. In source the paragraph, it describes various advancements in VR. It helped to emphasize the possible innovations becoming possible.

Rosa, S., & Breidt, M. (2018). Virtual reality: a new track in psychological research. British Journal of Psychology, 109(3), 427–430. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/29748966 on September 28, 2018.

The author of this article comments on the challenges concerning social interaction research. The research's goal is to is to achieve high experimental control over social interactions to allow for rigorous scientific reasoning. To do this requires more focus into psychological research. This is a relatively new path of research. This source was reliable and clear with its description of psychological research being done currently.

Vosburgh, K. G., Golby, A., & Pieper, S. D. (2013). Surgery, virtual reality, and the future. Studies in Health Technology and Informatics, 184, vii–xiii. Retrieved from

http://mutex.gmu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=

mnh&AN=23653952&site=ehost-live on September 28, 2018.

The findings from the research in this paper say that the greatest impact will

come from following two paths: One, improve technology so that it supports

enhanced surgeon performance seamlessly. Two: Re-engineer the technical

systems supporting the surgeon to create a more optimally effective environment.

I thought this source would complement nicely in the medical section. Using it

helped explain more about the possibility the future holds using virtual reality.

Woodford, C. (2018, March 14). What is virtual reality? - a simple introduction. Retrieved from

https://www.explainthatstuff.com/virtualreality.html on September 27, 2018.

The author in this article explains how virtual reality needs to be believable to

work. There are several aspects that one needs to investigate when beginning to

recreate a virtual reality. Specifically, this was categorized into interactivity,

immersion, believability, computer-generation, and exportability. It was an ideal

source to use for the basics of what virtual reality is.

Yiannakopoulou, E., Nikiteas, N., Perrea, D., & Tsigris, C. (2015). Virtual reality simulators and

training in laparoscopic surgery. International Journal of Surgery (London, England), 13,

60-64. DOI: http://dx.doi.org/10.1016/j.ijsu.2014.11.014

This article helps illustrate what was being said in the applications in medicine

portion of the paper. Evidence in the article suggests that performance on virtual

reality simulators reliably distinguishes experienced from novice surgeons. The

paper emphasizes that future research efforts should focus on the effect of virtual

reality simulation on performance in the context of advanced surgical procedure.

The content was very reliable, well organized and clearly explained.